

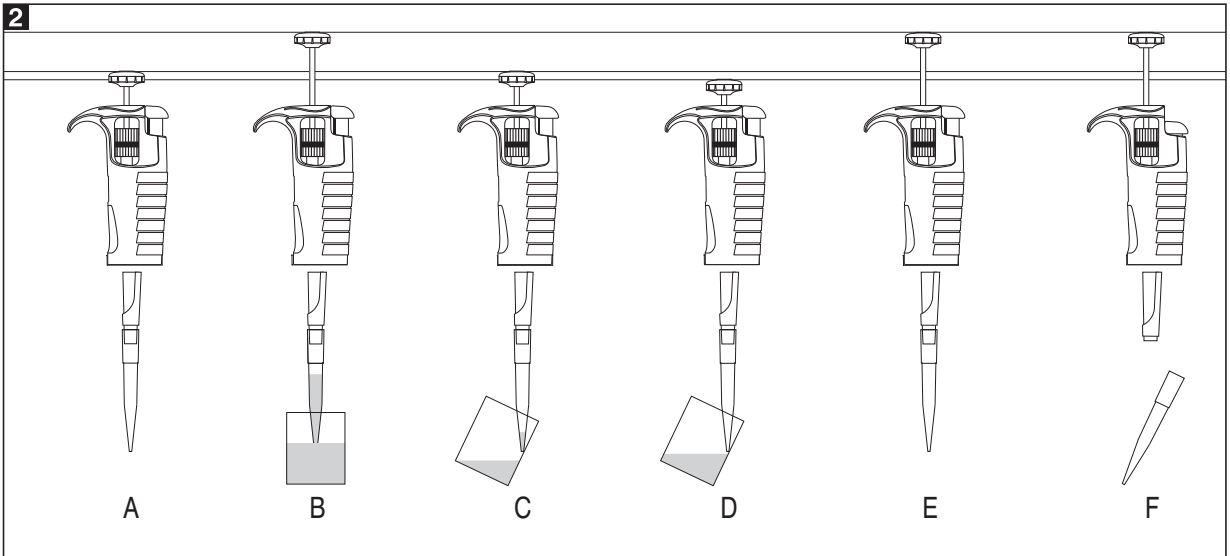
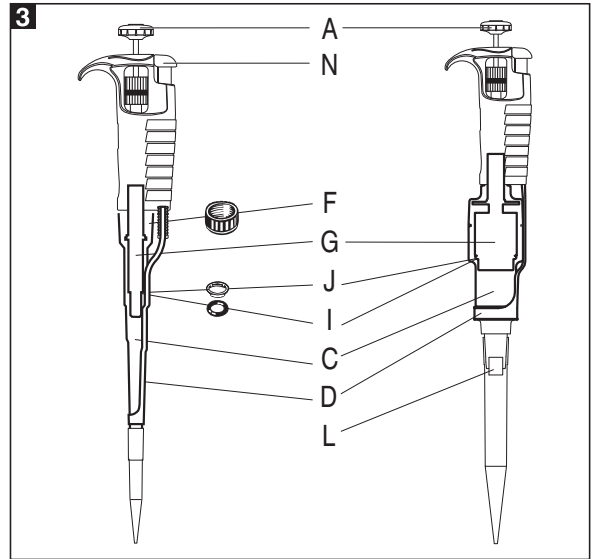
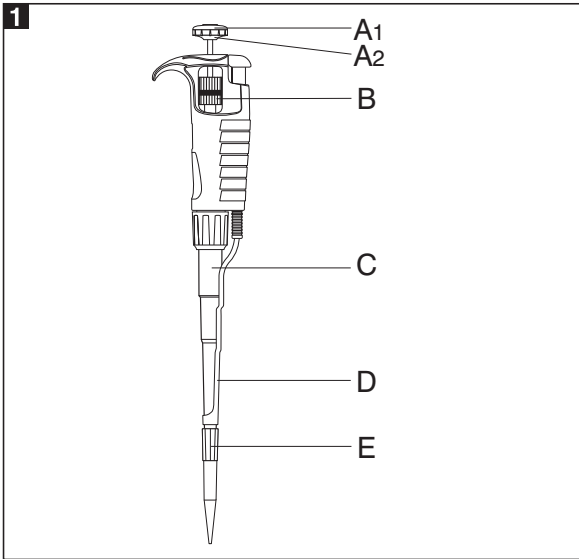
# GeneMate Pipettor



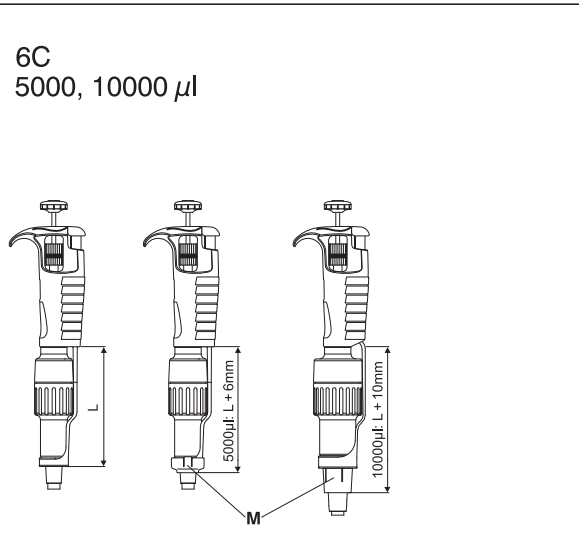
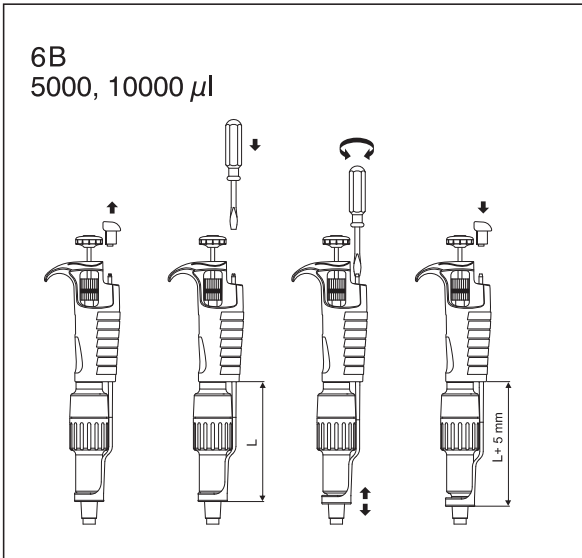
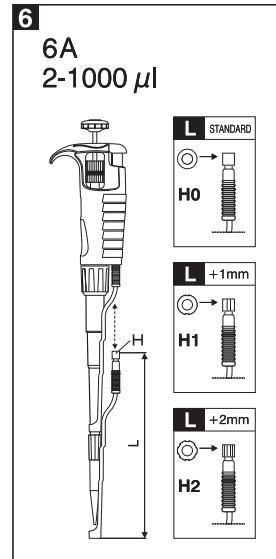
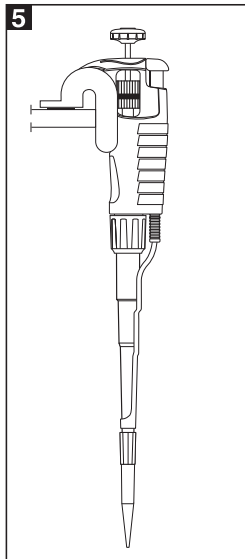
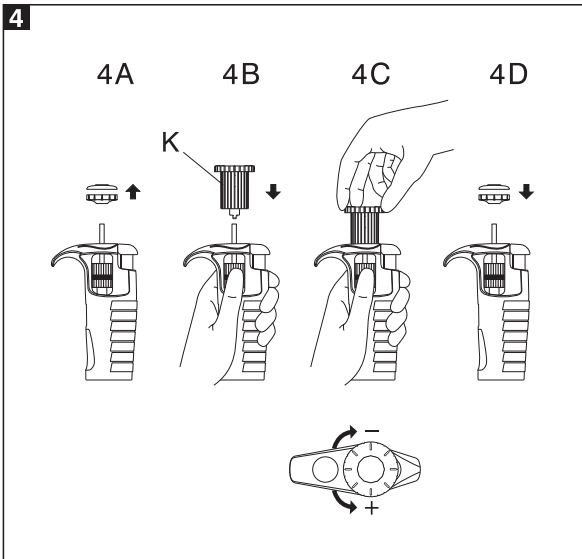
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# GeneMate Pipettor



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## 1 - INTRODUCTION

The **GeneMate Pipettor** is a volumetric instrument designed to measure and transfer liquids precisely and safely. It can measure and transfer volumes from 0.1  $\mu\text{l}$  to 10000  $\mu\text{l}$  depending on the model.

The **GeneMate Pipettors** are equipped with a digital counter which shows the pipetting volume. The set volume is visible in the window on the handle. The setting of the volume is done by turning of the pipetting pushbutton knob (Fig. 1A2) or by turning of the black knurled adjustment knob (Fig. 1B) in the right direction. The range of the volume of the aspired liquid is shown on the pipetting pushbutton (Fig. 1A1).

The **GeneMate Pipettors** pipettors are produced in 8 models, covering the volume range from 0.1  $\mu\text{l}$  to 10000  $\mu\text{l}$ .

Model	Volume range [ $\mu\text{l}$ ]
GM2	0.1 - 2
GM10	0.5 - 10
GM20	2 - 20
GM100	10 - 100
GM200	20 - 200
GM1000	100 - 1000
GM5000	1000 - 5000
GM10000	1000 - 10000
GM2, GM10	Measurement and transfer of micro-volumes, DNA sequencing and enzyme-assay applications.
GM20, GM100, GM200, GM1000	Measurement and transfer of general aqueous solution, acids and bases
GM5000, GM10000	Measurement and transfer of large volumes.

The liquid is aspirated into disposable tips attached to the pipettor shaft. Disposable tips ensure maximum safety and eliminate possibility of crosscontamination of the liquid samples.

To protect the user from contaminated tips the **GeneMate Pipettor** is equipped with a built-in tip ejector, (Fig. 1D).

The construction of the ejector enables the user to adjust the length. This allows for proper fit and ejection of nearly every tip type available. When using narrow tubes, it may be necessary to remove the tip ejector. It is simply removed by pulling down.

### Adjusting of the Tip Ejector Length

- in 2-1000  $\mu\text{l}$  pipettors (Fig. 6A).

The adjusting "H" spacers, included in the box allow for adjusting the length of tip ejector by +1mm or +2mm. An "H0" spacer is inserted on a standard basis. The outside shape of the spacer identifies the size change.

- in 5000 and 10000  $\mu\text{l}$  pipettors (Fig. 6B).

The length of tip ejector is adjusted by screwing in or screwing out the tip ejector stem with a screwdriver. Turn the screwdriver counter clockwise to increase the length of tip ejector, and clockwise to reduce the length of tip ejector. The ejector can be adjusted in the range of 5 mm. If above described method of ejector adjustment is not sufficient or the diameter of the ejector opening is too large to eject the tip it is necessary to put the ejector cap "M" onto the ejector, (Fig. 6C).

The **GeneMate Pipettor** is a high quality instrument which offers excellent accuracy and precision.

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The accuracy and precision (repeatability) of liquid volume depend on the quality of tips used. The values for accuracy and precision given in the table below were obtained using **GeneMate** tips. Only those tips guarantee correct operation of the pipettors and ensure accuracy and precision of liquid sampling.

Model	Volume [ $\mu$ l]	Accuracy [%]	Precision [%]	Fit to tips $\mu$ l
GM2	0.2	$\pm 12.0$	$\pm 6.0$	10
	1.0	$\pm 2.7$	$\pm 1.3$	
GM10	Max. 2.0	$\pm 1.5$	$\pm 0.7$	10
	Min. 0.5	$\pm 4.0$	$\pm 2.8$	
GM20	5.0	$\pm 1.0$	$\pm 0.6$	200
	Max. 10.0	$\pm 0.5$	$\pm 0.4$	
GM100	Min. 2	$\pm 3.0$	$\pm 1.5$	200
	10	$\pm 1.0$	$\pm 0.5$	
GM200	Max. 20	$\pm 0.8$	$\pm 0.3$	200
	Min. 10	$\pm 1.6$	$\pm 0.80$	
GM1000	50	$\pm 0.8$	$\pm 0.24$	1000
	Max. 100	$\pm 0.8$	$\pm 0.20$	
GM5000	Min. 20	$\pm 1.2$	$\pm 0.60$	5000
	100	$\pm 0.8$	$\pm 0.25$	
GM10000	Max. 200	$\pm 0.6$	$\pm 0.20$	10000
	Min. 100	$\pm 1.6$	$\pm 0.40$	
GM50000	500	$\pm 0.7$	$\pm 0.20$	5000
	Max. 1000	$\pm 0.6$	$\pm 0.15$	
GM100000	Min. 1000	$\pm 0.6$	$\pm 0.25$	10000
	5000	$\pm 0.8$	$\pm 0.3$	
GM500000	Max. 5000	$\pm 0.5$	$\pm 0.15$	5000
	Min. 1000	$\pm 2.5$	$\pm 0.6$	
GM1000000	5000	$\pm 0.8$	$\pm 0.3$	10000
	Max. 10000	$\pm 0.5$	$\pm 0.2$	

These specifications are obtained in forward mode, using a gravimetric method with the temperature of the distilled water, tips and all other conditions stabilized between 19°C and 21°C. Number of measurements - minimum 10. The values given include all components of error due to both normal handwarming and the changing of the tip.

Performance test: The pipettor is calibrated in accordance with EN ISO 8655. Performance can be verified by checking the pipettor using the procedures outlined in the EN ISO 8655 standard.

The pipettor design enables the user to perform the recalibration process according to the rules presented in section 8.

## 2 - SETTING THE VOLUME

The volume display shown by the counter has three digits, which should be read from top to bottom. In addition the lowest counter drum is printed in a scale which enables the setting of the volume in the minimum graduation range. Examples of the meanings of the black and red digits:

### Pipettors **GM2**

Red figures at the bottom =  $1/100 \mu$ l

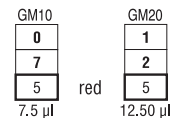
Increment =  $0.002 \mu$ l



### Pipettors **GM10, GM20,**

Red figures at the bottom =  $1/10 \mu$ l

Increment =  $0.02 \mu$ l



### Pipettors **GM100, GM200**

Black figures only =  $1 \mu$ l

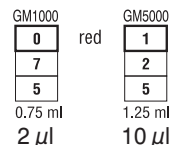
Increment =  $0.2 \mu$ l



### Pipettors **GM1000, GM5000,**

Red figures at the top - ml

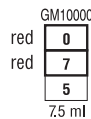
Increment =



### Pipettors **GM10000**

Red figures at the top - ml

Increment =  $20 \mu$ l



The volume of the pipettor is set by the knob in the pipetting pushbutton (Fig. 1A2) or by the black adjustment knob (Fig. 1B).

To attain the maximum accuracy, set volume must be approached from a higher value. If the desired value is lower than the previous value, simply use the knob in the pushbutton (Fig. 1A2) or the black adjustment knob (Fig. 1B) to adjust the value down to 1/3 turn above the required setting. If the desired value is higher than the previous value, use the knob in the pushbutton or the black adjustment ring to adjust the value to 1/3 turn

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above the required value. The setting should then be performed in the following manner:

With the volume set to 1/3 above the required setting, slowly turn the pipetting pushbutton knob or the black adjustment knob to the required volume.

If the knob is accidentally turned too far, ie is set lower than the required value, the process must be repeated. The approach to the set volume must always be made in the order of decreasing value.

## 3 - ASPIRATING AND DISPENSING LIQUIDS

Place a tip on the shaft of the pipettor. See Section 6 for the appropriate tip. Press the tip on firmly using a slight twisting motion. This will ensure an airtight seal.

**Important: Never aspirate liquids into the GeneMate Pipettor without a tip attached.**

### Aspiration

Press the pushbutton to the first positive stop, (Fig. 2A). Holding the pipettor vertically, immerse the tip into the sample liquid. The depth to which the tip is immersed in the sample liquid depends on the model.

Model	Immersion depth (mm)
GM2	≤ 1
GM10	≤ 1
GM20, GM100	2 – 3
GM200, GM1000	2 – 4
GM5000	3 – 6
GM10000	5 – 7

Release the pushbutton slowly and smoothly to aspirate the sample, (Fig. 2B). Wait one second and then withdraw the tip from the liquid. When the pipettor tip is immersed not as deeply as the recommended depth or when the pipetting pushbutton is rapidly released air may enter the disposable tip.

**Avoid touching the orifice of the tip.**

### Dispensing

- Place the end of the tip against the inside wall of the vessel at an angle of 10 to 40 degrees.
- Press the pushbutton smoothly to the first stop, (Fig. 2C). Wait one second.
- Press the pushbutton to the second stop to expel any remaining liquid, (Fig. 2D).
- Keeping the pushbutton depressed to the very end, remove the pipettor by drawing the tip against the inside surface of the receiving vessel.
- Release the pushbutton to its starting position, (Fig. 2E).
- Eject the tip by pressing the tip ejector button, (Fig. 2F). Remember to change the tip whenever a different liquid is to be sampled or the volume setting is changed.

### Filters

A replaceable filter installed in a seat in the bottom part of the shaft is used in 5000  $\mu$ l and 10000  $\mu$ l pipettors (Fig. 3L). The filter prevents the aspirated liquid from entering into the shaft and thus from polluting the inside of the shaft and the piston. Using the filter is especially important when aspirating and dispensing large volumes of liquid.

If the filter becomes wet during liquid aspiration it should be replaced with a new one.

## 4 - PRE-RINSING

When pipetting liquids of higher viscosity or lower surface tension than water (e.g. sera or organic solvents), a film of liquid is formed on the inside wall of the pipettor tip. This film can create an error. Since the film remains relatively constant in successive pipetting operations with the same tip, this error can be avoided by forming the film before transferring the first sample. This is done by aspirating a sample and dispensing it back into the same vessel. Since the film is already formed, all of the following samples will have better accuracy and repeatability.

This pre-rinsing operation should be repeated when the volume to be aspirated is changed or when a new tip is used.

## 5 - DENSE AND VISCOUS LIQUIDS

The **GeneMate Pipettor** specifications of accuracy and precision are based on pipetting distilled water. The han-

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dling of liquids with physical qualities of density, viscosity and surface tension differing extremely from water may need a gravimetrically checked compensation of the volume setting. Normally the degree of error resulting from heavy or viscous liquids is negligible if the pipetting is done slowly and carefully. It is most important to give the liquids some time to follow the change of pressure by holding the pipettor tip in its position for at least 2 sec. after the aspiration and the blow out stroke.

If in extreme cases this method of operation does not result in accurate values, a compensation could be achieved as follows:

Weigh the liquid pipettord when the **GeneMate Pipettor** is set to the nominal value. Then calculate the offset from the nominal value:

$$\text{Corr. val.} = 2 \times \text{nom. val.} - \frac{m}{\gamma}$$

$m$  - weight of the sample

$\gamma$  - density of liquid

Check this operation once again and correct if necessary. Note the corrected value for further pipetting the same kind of liquid.

## 6 - GENEMATE PIPETTOR TIPS

**GeneMate** tips are made from high performance polypropylene and their quality guarantees the precision and accuracy associated with the **GeneMate Pipettor**. Strict control is maintained throughout the manufacturing process to ensure the highest quality.

The accuracy and precision figures for the **GeneMate Pipettor** are only guaranteed when **GeneMate** tips are used. The use of inferior quality tips will seriously degrade the performance of the **GeneMate Pipettor**.

### Tips 10

These tips are used for volumes between 0.1  $\mu\text{l}$  and 10  $\mu\text{l}$ . They are used with the GM2 and the GM10 models.

### Tips 200

These tips are used for volumes between 2  $\mu\text{l}$  and 200  $\mu\text{l}$ . They are used with the GM20, GM100 and the GM200 models.

### Tips 1000

These tips are used for volumes between 100  $\mu\text{l}$  and 1000  $\mu\text{l}$ . They are used with the GM1000 models.

### Tips 5000

These tips are used for volumes between 1000  $\mu\text{l}$  and 5000  $\mu\text{l}$ . They are used with the GM5000 models.

### Tips 10000

These tips are used for volumes between 1000 and 10000  $\mu\text{l}$ . They are used with the GM10000 models.

## 7 - RECOMMENDATIONS

Observing the following recommendations will ensure maximum possible accuracy and precision of liquid sampling.

- Make sure to operate the **GeneMate Pipettor** slowly and smoothly.
- The depth of immersion in the sample liquid should be the minimum necessary and should remain constant during aspiration.
- The **GeneMate Pipettor** should be held in a vertical position.
- Change the tip when volume setting is changed or when a different liquid is to be aspirated.
- Change the tip if a droplet remains on the end of the tip from the previous pipetting operation.
- Each new tip should be pre-rinsed with the liquid to be pipettord.
- Liquid should never enter the **GeneMate Pipettor** shaft. To prevent this:
  - Press and release the pushbutton slowly and smoothly.
  - Never turn the pipettor upside down.
  - Never lay the pipettor on its side when there is liquid in the tip.
- Never force the volume setting beyond its recommended limits.
- When pipetting liquids with temperatures different from the ambient temperature, it is recommended to pre-rinse the tip several times before use.
- Do not pipettor liquids with temperatures above 70°C.

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- When pipetting acids or corrosive solutions which emit vapors, it is recommended to disassemble the shaft and to rinse the piston and seal with distilled water after finishing the pipetting operation.

## 8 - RECALIBRATION

**GeneMate Pipettors** are calibrated by gravimetric method, using **GeneMate** tips and distilled water, at the temperature  $20 \pm 1^\circ\text{C}$ , according to EN ISO 8655 standard.

If during pipettor operation you find that the accuracy error (the difference between the real aspirated volume and the preset volume) exceeds the permissible value given in the table in section 1, the pipettor recalibration procedure should be carried out.

Before starting the recalibration it is necessary to check whether the following requirements have been fulfilled during error determination:

- the ambient temperature, and the temperature of the pipettor, tips and water was identical
- the density of the liquid used is close to that of distilled water
- a balance with appropriate sensitivity has been used.

Volume checked [ $\mu\text{l}$ ]	Balance sensitivity [mg]
0.1 - 10	$\leq 0.001$
10 - 100	$\leq 0.01$
> 100	$\leq 0.1$

- mg/ $\mu\text{l}$  conversion factor has been taken into account
- the requirements given in sections 3 and 7 have been fulfilled

If the above conditions are satisfied and the accuracy error for selected volume given in section 1 exceeds the permissible value, the pipettor recalibration procedure should be carried out.

**The recalibration can be performed within one full turn of the key to the right or to the left only.**

### Recalibration conditions:

- Ambient temperature and the temperature of the pipettor, tips and liquid should be within the range  $20\text{-}25^\circ\text{C}$  and stabilized during weighing within  $\pm 0.5^\circ\text{C}$
- Measurements should be conducted using distilled water
- Balance sensitivity should be suitable for the volume to be controlled

### Recalibration procedure:

- Set the dose volume depending on the pipettor volume according to the following table:

Model	Range of the pipettor volumes [ $\mu\text{l}$ ]	Preset volume [ $\mu\text{l}$ ]	Permissible volumes [ $\mu\text{l}$ ]	Volume change $\Delta V$ for full turn of the calibration key [ $\mu\text{l}$ ] (24 increments)
GM2	0.1 - 2	0.2	0.176 - 0.224	0.06
GM10	0.5 - 10	0.5	0.48 - 0.52	0.33
GM20	2 - 20	2	1.94 - 2.06	0.63
GM100	10 - 100	10	9.84 - 10.16	2.50
GM200	20 - 200	20	19.76 - 20.24	6.30
GM1000	100 - 1000	100	98.4 - 101.6	25.00
GM5000	1000 - 5000	1000	994 - 1006	125.00
GM10000	1000 - 10000	1000	975 - 1025	250.00

- Perform 5 aspirations, weigh each one and calculate the average value of the aspirations
- Calculate average aspirated volume in  $\mu\text{l}$  multiplying the average aspiration amount [mg] by the distilled water density coefficient [ $\mu\text{l}/\text{mg}$ ], which depends on temperature and pressure according to the following table:

Temperature [ $^\circ\text{C}$ ]	Pressure [kPa]		
	95.0	101.3	105.0
20	1.0028	1.0029	1.0029
21	1.0030	1.0031	1.0031
22	1.0032	1.0033	1.0033
23	1.0034	1.0035	1.0036
24	1.0037	1.0038	1.0038
25	1.0039	1.0040	1.0040

If the average aspirated volume exceeds the permissible value, the following should be done:

- Remove the pipetting pushbutton, (Fig. 4A),

**Warning: The pipetting pushbutton consists of 2 parts: the knob (Fig. 1A2) and the pushbutton (Fig. 1A1). After removal of the pushbutton, both parts are separated.**

- Holding the black knurled volume adjustment knob to protect it against rotation, insert the calibration key into the cuts of the calibration screw, (Fig. 4B),



- Turn the key clockwise to reduce the aspirated volume, or counter-clockwise to increase the volume. One full turn of the calibration key changes the pipettor aspiration volume by the amount given in the table, (Fig. 4C),
- Take out the key and fix the pipetting pushbutton (Fig. 4D). The pipetting pushbutton should be fixed by placing the knob on the arbor first (Fig. 1A2) and then the pushbutton (Fig. 1A1).

Determine the average aspirated volume. The average volume should be within the permissible range given in the table. If the volume exceeds the values stated, the recalibration procedure should be repeated.

When pipetting liquids with physical properties considerably different from those of water, follow the rules given in section 5.

## 9 - TROUBLESHOOTING

If you notice an improper pipettor operation, identify the cause and eliminate the fault. To do this, follow the instructions in the sequence provided. Replacement of parts should be required only occasionally, and should not occur under normal pipettor use.

### **Droplets of liquid remain in the pipettor tip.**

- The tip is emptied too fast.  
**Decrease the speed of pressing the pipettor pushbutton.**
- The tip wettability has increased due to extensive use.  
**Replace the tip with a new one.**

### **Droplets of air appear in the liquid aspirated into the tip.**

- The pipettor tip immersion is too shallow.  
**Immerse the tip deeper according to the instructions.**
- The pipettor tip is incorrectly pressed onto the pipettor shaft.  
**Press the pipettor firmly.**
- The tip is damaged or worn out due to extensive use.  
**Replace the tip with a new one.**

### **The pipettor incorrectly aspirates the liquid or liquid drops out from the tip.**

- The pipettor tip is incorrectly pressed onto the pipettor shaft.  
**Press the pipettor tip firmly.**
- The shaft nut is loose (Fig. 3F) in the models GM2-GM1000

### **Tighten the shaft nut.**

- The sealing surface of the shaft is cracked or scored.  
**Remove the tip ejector. Unscrew the shaft nut, inspect the shaft and the piston assembly. Replace the damaged parts (see Section 12). When reassembling the pipettor, the nut should be hand tightened. In the models GM2, GM10 and GM20, the damage of the shaft may also cause a damage of the piston assembly. Replace the damaged parts (see Section 12). When reassembling the pipettor, the nut should be hand tightened. To remove the tip ejector in models GM5000 and GM10000, remove the ejector pushbutton (Fig. 3N) and using a screwdriver unscrew the tip ejector by turning the screwdriver counter-clockwise.**
- Damage to the piston or seal due to prolonged use with the aggressive liquids.  
**Disassemble the pipettor as described above. Replace the piston, seal and O-ring (see Section 12). Rinse the inside of the shaft in distilled water and dry. Lubricate the seal and O-ring with the lubricant, that has been included with each pipettor. The replacement of the piston requires conducting of calibration procedure. Note: The parts of GM2 and GM10 pipettor should be lubricated evenly with a minimum amount of lubricant.**
- The pipettor is reassembled improperly.  
**Disassemble the pipettor and reassemble it, observing the proper sequence of steps (Fig. 3).**
- No lubricant on the sealing elements.  
**Remove the tip ejector. Unscrew the shaft nut, remove the shaft, piston assembly, seal and O-ring. Rinse the removed parts in distilled water and dry thoroughly. Lightly lubricate the inside surfaces of the seal and the O-ring with the included lubricant. Reassemble the pipettor in the reverse order.**
- Contamination of the inside of the pipettor caused by extensive aspiration of chemically aggressive liquids or because liquid got inside the pipettor.  
**Remove the tip ejector. Unscrew the nut, remove the shaft, piston assembly, seal and O-ring. Rinse the removed parts with distilled water and dry thoroughly. Lightly lubricate the inside surfaces of the**

**seal and the O-ring with the lubricant. Reassemble the pipettor in the reverse order.**

**If you find an increase in the pipetting force, which may happen after repetitive autoclaving of the pipettor:**

**Remove the tip ejector. Unscrew the shaft nut, and then remove the shaft, piston assembly, seal and O-ring. Rinse the removed parts in distilled water and dry. Lubricate the internal surfaces of the seal and O-ring with lubricant that has been included with each pipettor. Reassemble the pipettor in opposite order.**

**Note: All parts of the pipettor can be autoclaved (see Section 10)**

**The shaft of the 5000 and 10000 models should be autoclaved without the filter.**

If the problem continues after carrying out the above steps, contact your **BioExpress** representative.

Before returning the pipettor, please ensure that the pipettor is completely free of any chemical, radioactive or microbiological contamination which could pose a threat during transport and repair. As far as it is possible, clean the pipettor.

## 10 - CLEANING AND STERILIZATION

### Cleaning

External surfaces of the pipetting pushbutton, the ejector pushbutton, the handgrip, the shaft nut and the adjustment knob may be cleaned using a cloth dampened in isopropyl alcohol. The remaining parts removed from the pipettor during pipettor disassembly may be washed with distilled water or isopropyl alcohol.

### Sterilization:

The pipettor can be sterilized in an autoclave at 121°C for 20 minutes. After sterilization, the pipettor should be dried and cooled to room temperature.

### It is recommended:

- to sterilize the pipettors in autoclave with an initial vacuum and drying cycle,
- prior to sterilization unscrew the shaft nut slightly in the GM2-GM1000 pipettors, and unscrew the shaft slightly in the GM5000 and GM10000. After autoclaving these parts should be screwed tight again.

The precision of the results should not alter if the pipetting process and autoclaving are carried out as described in this manual. Because a slight change in the accuracy of the dosage may occur, it is recommended to:

- check the calibration of the pipettor after the initial first, third and fifth autoclaving cycles and then after every 10 autoclaving cycles.

## 11 - PIPETTOR KIT AND ACCESSORIES

### Pipettor kit:

The pipettors are delivered in the kits including:

- Pipettor
- Instruction manual
- Calibration key
- Pipettor stand
- Ejector regulation spacers (for pipettor models GM2 - GM1000)
- Ejector cap (for pipettor models GM5000, GM10000)
- Tips
- Identification labels
- Filters (for pipettor models GM5000, GM10000)
- Lubricant

The stand assembly diagram is shown in Fig. 5.

### Accessories:

Description
10 $\mu$ l tips, racked
200 $\mu$ l tips, racked
1000 $\mu$ l tips, racked
5000 $\mu$ l tips, bulk pack
10000 $\mu$ l tips, bulk pack
Carousel stand for 6 pipettors
Linear stand for 6 pipettors

## 12 - SPARE PARTS

The spare parts indicated in Fig. 3, 4 and 6 that is:

**A: Pipetting pushbutton A1: Pushbutton A2: Knob**

**B: Adjustment knob**

**C: Shaft**

**D: Ejector**

**F: Shaft nut**

**G: Piston assembly**

**H: Spacer**

**I: O-ring**

**J: Seal**

**K: Calibration key**

**L: Filter**

**M: Ejector cap**

**N: Ejector pushbutton**

can be ordered from your **BioExpress** representative (type of pipettor and name of the part for this pipettor should be specified).

**Warning: The replacement of the piston requires conducting of calibration procedure according to section 8.**

Before returning a pipettor to a **BioExpress** representative please ensure that the pipettor is completely free of any contamination (chemical, microbial or radioactive).

Contact **BioExpress** at 800-999-2901.